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ASSESSMENT OF THE SIGNIFICANCE OF FACTORS AFFECTING THE STRENGTH OF FIBER CONCRETE

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Abstract. *The article describes a method for assessing the effect of the length and amount of basalt fiber added to the composition of fiber concrete on its strength based on dispersion analysis.*

Keywords: *fiber concrete, dispersion analysis, Fisher criteria, quality factors, null hypothesis.*

During the construction and operation of buildings and structures made of concrete, various cracks may form as a result of the effects of deformations or irregularities, shock, vibration and other dynamic loads, errors in reinforcement, strength, elasticity and fragility of the materials used.

It is possible to prevent the above-mentioned causes of cracks in concrete and reduce their impact on the properties of the material by using dispersed concrete reinforcement [1,7].

Currently, instead of traditional reinforcement, reinforcement in whole or in part with special dispersion reinforcement has become widespread. It is a simple concrete reinforced with various fibers (fibers).

Compared with conventional reinforcement (reinforcement grids), basalt or polypropylene fibers are evenly distributed in the volume of concrete. [2,6].

One of the modern structural materials that will be used in the future is dispersed reinforced concrete. Such concretes are a variety of composite materials of a wide range and are widely used in various industries today. Dispersion reinforcement is carried out by applying fibers-fibers that are evenly distributed throughout the entire volume of the concrete matrix [3,8].

The analysis of technical literature makes it possible to identify areas in which various fibers can be effectively used as dispersed reinforcement, and to identify certain patterns that can be generally recognized:

- the properties of fiber concrete are determined by the type of fiber and concrete used, their quantitative ratio and will largely depend on the state of the bonds at the phase separation limit;

- a significant increase in the strength indicators of the composite compared to the initial concrete is provided by the use of high-tech fibers that are chemically resistant to the matrix and have a higher modulus of elasticity;

- the type of fibers, the relative length and the percentage composition of their mixture must meet the requirements for the product, and the structure and requirements of the adopted technology, while deviation to a greater or lesser extent from the optimal parameters reduces the efficiency of dispersion reinforcement;

- the addition of fibers within the optimal parameters to the concrete structure leads to an improvement in the structure and properties of the initial concrete, an increase in its strength and durability.

Currently, there has been a significant increase in interest in the use of fiber as the basis of building structures, in particular, in the use of such fibers as reinforcement. This interest arose on the basis of the efforts of specialists to improve the physical characteristics of concrete structures due to the high requirements of modern construction work.

The use of fiber as reinforcement to eliminate the missing tensile strength of materials made of concrete can become the basis for the creation of a new type of concrete that allows it to be widely used in construction.

Currently, metal (mainly steel) and non-metallic (mineral, polymer and other) materials of various lengths and cross-sections with high and low modules are used for dispersed reinforcement of concrete.

Studies of samples of dispersed reinforced concrete based on basalt fibers have indeed shown an increase in the strength of concrete. The experiments were carried out on concrete cubic samples with sides of 10 cm, prepared under the same conditions. Basalt fibers in a two-factor experimental plan 5, 10, 15, 20, 25, and a length of 30 mm (l), while the amount of concrete content (mv) was 0.1; 0.15; 0.2; 0.25; in the amount of 0.3 and 0.5 percent, and the number of samples was set to 3 for each variant of factors.The experiments were carried out 28 days after the day of filling the samples, and the following results were obtained (the table shows the arithmetic mean values of the results):

<table>
<tr><td rowspan="3">Length of fibers</td><td colspan="6">The volumetric amount of fiber in the composition of concrete (μ_v), %</td></tr>
<tr><td>0.5</td><td>0.75</td><td>1</td><td>1.25</td><td>1.5</td><td>2.5</td></tr>
<tr><td colspan="6">Compressive strength indicators, MPa</td></tr>
<tr><td>Without fiber</td><td colspan="6">31.8</td></tr>
<tr><td>5 mm</td><td>37.4</td><td>37.9</td><td>38.1</td><td>38.3</td><td>39.8</td><td>28.9</td></tr>
<tr><td>10 mm</td><td>36.9</td><td>37.1</td><td>37.6</td><td>39.6</td><td>35.4</td><td>31.0</td></tr>
<tr><td>15 mm</td><td>34.5</td><td>37.2</td><td>38.9</td><td>38.3</td><td>38.2</td><td>30.2</td></tr>
<tr><td>20 mm</td><td>32.9</td><td>36.0</td><td>38.5</td><td>37.3</td><td>37.0</td><td>28.3</td></tr>
<tr><td>30 mm</td><td>27.2</td><td>35.4</td><td>38.3</td><td>35.4</td><td>33.6</td><td>29.0</td></tr>
</table>

When processing the experimental results, the task was set to determine which factor most affects the increase in the strength of fibroconcrete. To solve the problem, the method of dispersion analysis of mathematical statistics was used. Dispersion analysis is convenient because it allows us to assess the influence of immeasurable qualitative factors on quantitative indicators [4,9,10].

Initially, the degree of significance of the influence of fiber length on the strength of fiber concrete was studied at α = 0.05 (provided that the content of basalt fibers in concrete (mv) is 1.5%).

$\overline{j= (1,3)}$	Fiber length factor l_j , $\overline{j= (1,5)}$				
	l_1 = 5 mm	l_2 = 10 mm	l_3 = 15 mm	l_4 = 20 mm	l_5 = 30 mm
Sample 1	39,2	34,9	36,6	38,8	33,4
Sample 2	40,0	36,6	39,4	35,5	34,3
Sample 3	40,2	34,7	38,6	36,7	33,1
Average value $\bar{X}_{grj}$	$\bar{X}_{gr1}$ = 39,8	$\bar{X}_{gr2}$ = 39,8	$\bar{X}_{gr3}$ = 39,8	$\bar{X}_{gr4}$ = 39,8	$\bar{X}_{gr5}$ = 39,8

Average value $\bar{X}_{grj}$:

$$\bar{X}_{grj} = \frac{1}{n}\sum_{i=1}^{n} X_{ij} = \frac{X_{1j} + X_{2j} + \cdots + X_{nj}}{n} , \qquad (1)$$

Total average value $\bar{X}$:

$$\bar{X} = \frac{1}{k \cdot n}\sum_{i=1}^{n}\sum_{j=1}^{k} X_{ij} = \frac{1}{k}\sum_{j=1}^{k} \bar{X}_{grj} , \qquad (2)$$

$$\bar{X} = \frac{\bar{X}gr1 + \bar{X}gr2 + \bar{X}gr3 + \bar{X}gr4 + \bar{X}gr5}{5} = 36{,}8$$

To determine the influence of the studied factor, the total sample variance is divided into two parts, the first is the factor variance - S^2_{fact}, the second is the residual variance -S^2_{res}

To determine these values, the total sum of the squared deviations is first determined:

$$Q_{total} = \sum_{i=1}^{n}\sum_{j=1}^{k}\left(X_{ij} - \bar{X}\right)^2 \qquad (3)$$

Difference $y_{ij} = \bar{X}_{ij} - \bar{X}$ and the values of their squares are entered in the table:

j=$\overline{(1,3)}$	Fiber length factor l_j , j=$\overline{(1,5)}$									
	l_1 = 5 mm		l_2 = 10 mm		l_3 = 15 mm		l_4 = 20 mm		l_5 = 30 mm	
	y_{i1}	y^2_{i1}	y_{i2}	y^2_{i2}	y_{i3}	y^2_{i3}	y_{i4}	y^2_{i4}	y_{i5}	y^2_{i5}
Sample 1	2,4	5,76	-1,9	3,61	-0,2	0,04	2,0	4,0	-3,1	9,61
Sample 2	3,2	10,24	-0,2	0,04	2,6	6,76	-1,3	1,69	-2,5	6,25
Sample 3	3,4	11,56	-2,1	4,41	1,8	3,24	0,2	0,04	-3,7	13,69
Σ	-	27,56	-	8,06	-	10,04	-	5,73	-	29,55

Total amount:

Q_{total} = 27,56+8,06+10,04+5,73+29,55=80,94

The sum of the factor

$$Q_{fact} = n\sum_{j=1}^{k}\left(\bar{X}_{grj} - \bar{X}\right)^2, \qquad (4)$$

Q_{fact} = 3((39,8-36,8)^2+(35,4-36,8)^2+(38,2-36,8)^2+(37-36,8)^2+(33,6-36,8)^2)=69,6

Remaining amount:

Q_{rem}= $Q_{total} - Q_{fact}$=80,94-69,6=11,34

The variance of the factor is determined- S^2_{fact}, and the residual variance is S^2_{res} :

$$S^2_{fact} = \frac{Q_{fact}}{k-1} = \frac{69,6}{5-1} = 17,4$$

$$S^2_{res} = \frac{Q_{res}}{k(n-1)} = \frac{11,34}{5(3-1)} = 1,134$$

To test the null hypothesis, i.e. the fiber length (l, mm) does not affect the strength of fiber concrete (the degree of significance is α= 0.05), we use the Fisher criterion, that is, we test the hypothesis that factorial and residual variances are distributed normally:

We find the calculated value of the Fisher criterion

$$F_{sett} = \frac{S^2_{fact}}{S^2_{res}} = \frac{17,4}{1,134} = 15,34$$

From the Fischer distribution table ([4] Appendix 1) for the degree of significance α=0.05 and degrees of freedom

for k_1= k-1 = 5-1 =4; k_2= k(n-1) = 5(3-1)=10 the Fisher criterion is equal to:

$F_{crit.}$(0,05;4;10)=3,48

Since, $F_{crit.}$=3.48 < $F_{cal.}$=15.34 , it can be concluded that the effect of fiber length (l, mm) on the strength of fiber concrete is significant. Therefore, we deny the null hypothesis.

The study also assessed the significance of the influence of the amount of basalt fiber added (μ_v, %) on the strength of fiber concrete relative to the volume of samples.

It calculates the value of the Fisher criterion:

$$F_{cal} = \frac{S^2_{fact}}{S^2_{res}} = \frac{33,35}{1,83} = 18,22\,,$$

The value of the Fisher criterion according to the table:

for k_1= k-1 = 6-1 =5; k_2= k(n-1) = 6(3-1)=12 is equal to:

$F_{crit.}$(0,05;5;12)=3,11

Since, $F_{crit.}$=3.11 < $F_{cal.}$=18.22, the null hypothesis is refuted, and the effect of the amount of basalt fiber added to the fiber concrete content (μ_v, %) on the strength of the sample is estimated as significant.

LITERATURE:

1. Волков И.В. Фибробетон: состояние и перспективы применения в строительных конструкциях / И.В.Волков// Строительные материалы, оборудование, технологии XXI века. 2004. №5. С.24-25.

2. Рабинович Ф.Н. Композиты на основе дисперсно-армированных бетонов //Ф.Н.Рабинович. Москва: Стройиздат, 2011. 642 с.

3. Клюев А.В. Расчет процента армирования фибробетонных композитов / А.В.Клюев // Москва: Вестник МГСУ №5, 2015. С.4.

4. Черняк М. Ю., Эльберг М. С. Планирование и организация эксперимента: практикум для бакалавров направления подготовки 221700.62 «Стандартизация и метрология» всех форм обучения / сост. :; Сиб. гос. аэрокосмич. ун-т. – Красноярск, 2014. – 88 с.

5. Alinazarov A. K., Khusainov M. A., Gaybullaev A. H. Applications of Coal Ash in the Production of Building Materials and Solving Environmental Problems //Global Scientific Review. – 2022. – Т. 8. – С. 89-95.

6. Rakhimov, A. M., Khusainov, M. A., Turgunpulatov, M. M., & Sh, T. (2022). OPTIMAL MODES OF CONCRETE HEAT TREATMENT. *Новости образования: исследование в XXI веке*, *1*(3), 594-597.

7. Khakimov, S. A., Mamadov, B. A., & Madaminova, M. U. (2022). CONTINUOUS VAPORING PROCESSES IN NEW FILLED CONCRETE. *Innovative Development in Educational Activities*, *1*(3), 54-59.

8. Хусаинов, М. А., Эшонжонов, Ж. Б., & Муминов, К. (2018). ҲОЗИРГИ ЗАМОН МАСЖИДЛАРИНИНГ ҲАЖМИЙ-РЕЖАВИЙ ЕЧИМЛАРИ ХУСУСИДА. *Вестник Науки и Творчества*, (6 (30)), 64-69.

9. Khusainov, M. A., Poshshokhujaeva, D. V., Khusainov, S. M., & Khusainova, K. M. Features of the Architectural Appearance of Modern Mosques in Central Asia. *International Journal on Integrated Education*, *3*(12), 267-273.

10. Хусаинов, М. А., & Солиев, И. И. (2015). Возможности использования кластерной модели развития бизнеса в Узбекистане. *Молодой ученый*, (17), 472-475.

11. Хусаинов, М. А., & Сирожиддинов, И. К. (2016). Инновационные факторы экономического развития и их особенности в регионе. *Молодой ученый*, (11), 1063-1065.

12. Raximov, A. M., Alimov, X. L., To'xtaboev, A. A., Mamadov, B. A., & Mo'minov, K. K. (2021). Heat And Humidity Treatment Of Concrete In Hot Climates. *International Journal of Progressive Sciences and Technologies*, *24*(1), 312-319.

13. Рахимов, А. М., Акрамова, Д. Ғ., Мамадов, Б. А., & Курбонов, Б. И. (2022). Ускорение твердения бетона при изготовлении сборных железобетонных изделий. *Conferencea*, 20-22.

14. Muminov, K. K., Cholponov, O., Mamadov, B. A., oglu Bakhtiyor, M., & Akramova, D. Physical Processes as a Result of Concrete Concrete in Dry-hot Climate Conditions. *International Journal of Human Computing Studies*, *3*(2), 1-6.

15. Mamadov, B., Muminov, K., Cholponov, O., Nazarov, R., & Egamberdiev, A. Reduction of Destructive Processes in Concrete Concrete Processing in Dry-hot Climate Conditions. *International Journal on Integrated Education*, *3*(12), 430-435.

16. Рахимов А. М., Мамадов Б. А. ЭНЕРГОСБЕРЕГАЮЩИЕ МЕТОДЫ УСКОРЕНИЯ ТВЕРДЕНИЯ БЕТОНА //НАУЧНЫЙ ЭЛЕКТРОННЫЙ ЖУРНАЛ «МАТРИЦА НАУЧНОГО ПОЗНАНИЯ». – С. 81.

17. Рахимов, А. М., Жураев, Б. Г., & Эшонжонов, Ж. Б. (2017). ОСОБЕННОСТИ ТЕПЛОВОЙ ОБРАБОТКИ БЕТОНА В РАЙОНАХ С ЖАРКИМ КЛИМАТОМ. *Вестник Науки и Творчества*, (1 (13)), 96-98.

18. Рахимов, А. М., Ахмедов, П. С., & Мамадов, Б. А. (2017). РАЦИОНАЛЬНЫЕ ГРАНИЦЫ ПРИМЕНЕНИЯ РАЗЛИЧНЫХ МЕТОДОВ УСКОРЕНИЯ ТВЕРДЕНИЯ БЕТОНА С ТОЧКИ ЗРЕНИЯ РАСХОДА ЭНЕРГОРЕСУРСОВ. *Science Time*, (5 (41)), 236-238.

19. Рахимов, А. М., Абдурахмонов, С. Э., Мамадов, Б. А., & Каюмов, Д. А. Ў. (2017). НЕКОТОРЫЕ АСПЕКТЫ ТЕПЛОВОЙ ОБРАБОТКИ БЕТОНА В РАЙОНАХ С ЖАРКИМ КЛИМАТОМ. *Вестник Науки и Творчества*, (3 (15)), 110-113.

20. Рахимов, А. М., & Жураев, Б. Г. (2016). Исследование температурных полей в процессе пропаривания и остывания бетонных изделий в условиях повышенных температур среды. *Символ науки*, (2-2), 72-73.

21. Рахимов А. М., Жураев Б. Г., Хакимов Ш. А. Энергосберегающий метод тепловой обработки бетона в районах с жарким климатом //Символ науки. – 2016. – №. 4-3. – С. 63-65.

22. Фозилов О. К., Рахимов А. М. Пути снижения энергетических затрат при производстве сборных железобетонных изделий в районах с жарким климатом //Приоритетные направления развития науки. – 2014. – С. 73-75.

23. Рахимов А. М., Жураев Б. Г., Эшонжонов Ж. Б. ОСОБЕННОСТИ ТЕПЛОВОЙ ОБРАБОТКИ БЕТОНА В РАЙОНАХ С ЖАРКИМ КЛИМАТОМ //Вестник Науки и Творчества. – 2017. – №. 1 (13). – С. 96-98.

24. Rahimov A. M. Issledovanie temperaturnyh polej v processe proparivaniya i ostyvaniya betonnyh izdelij v usloviyah povyshennyh temperatur sredy //Simvol nauki. – 2016. – №. 2. – С. 72-73.

25. Rahimov A. M., Muminov K. K. Concrete Heat Treatment Methods //Czech Journal of Multidisciplinary Innovations. – 2022. – Т. 10. – С. 4-14.

26. Rakhimov A. M. et al. OPTIMAL MODES OF CONCRETE HEAT TREATMENT //Новости образования: исследование в XXI веке. – 2022. – Т. 1. – №. 3. – С. 594-597.

27. Хакимов Ш. А., Мартазаев А. Ш., Ваккасов Х. С. Расчет грунтовых плотин методом конечных элементов //Инновационная наука. – 2016. – №. 2-3 (14). – С. 109-111.

28. Ҳакимов ША М. К. К., Эгамбердиев И. Х. ОСОБЕННОСТИ ТВЕРДЕНИЯ БЕТОНА НА ПОРТЛАНДЦЕМЕНТЕ С УЧЕТОМ ПОГОДНО-КЛИМАТИЧЕСКИХ ФАКТОРОВ //МЕХАНИКА ВА ТЕХНОЛОГИЯ ИЛМИЙ ЖУРНАЛИ. – 2021. – №. 4. – С. 102.

29. Abduraxmanovich X. S. H. HELIOTHERMO CONCRETE PROCESSING IN HOT CLIMATES //INFORMATION TECHNOLOGY IN INDUSTRY. – 2021. – Т. 9. – №. 3. – С. 973-978.

30. Хакимов Ш. А., Ваккасов Х. С., Бойтемиров М. Б. У. Основные принципы проектирования энергоэффективных зданий //Вестник Науки и Творчества. – 2017. – №. 3 (15). – С. 136-139.

31. Хакимов Ш. А., Чулпонов О. Г. ОПИТ ИСПОЛЬЗОВАНИЯ СОЛНЕЧНОЙ ЭНЕРГИИ ПРИ ИЗГОТОВЛЕНИИ БЕТОННЫХ ИЗДЕЛИЙ НА ОТКРЫТЫХ ПЛОЩАДКАХ //НАУЧНЫЙ ЭЛЕКТРОННЫЙ ЖУРНАЛ «МАТРИЦА НАУЧНОГО ПОЗНАНИЯ». – С. 93.

32. Хакимов Ш. А., Муминов К. К. ОБЕЗВОЖИВАНИЕ БЕТОНА В УСЛОВИЯХ СУХОГО-ЖАРКОГО КЛИМАТА //НАУЧНЫЙ ЭЛЕКТРОННЫЙ ЖУРНАЛ «МАТРИЦА НАУЧНОГО ПОЗНАНИЯ». – С. 86.

33. Khakimov S. A., Mamadov B. A., Madaminova M. CONTINUOUS VAPORING PROCESSES IN NEW FILLED CONCRETE //Innovative Development in Educational Activities. – 2022. – Т. 1. – №. 3. – С. 54-59.

34. Хакимов Ш. А., Ваккасов Х. С., Каюмов Д. А. У. ПРОБЛЕМЫ ОБЕСПЕЧЕНИЯ ЭНЕРГОСБРЕЖЕНИЯ И ПОВЫШЕНИЯ ЭНЕРГОЭФФЕКТИВНОСТИ ЗДАНИЙ, ОСНОВНЫЕ НАПРАВЛЕНИЯ ИХ РЕШЕНИЯ //Вестник Науки и Творчества. – 2017. – №. 3 (15). – С. 140-142.

35. Ваккасов Х. С., Фозилов О. К., Мартазаев А. Ш. ЧТО ТАКОЕ ПАССИВНЫЙ ДОМ //Вестник Науки и Творчества. – 2017. – №. 2 (14). – С. 30-33.

36. Saidmamatov A. T. et al. Mathematical Model of the Optimization Problem Taking Into Account a Number of Factors //European Journal of Research Development and Sustainability. – 2021. – Т. 2. – №. 3. – С. 1-2.

37. Saidmamatov A. T. et al. Analysis of Theory and Practice of Optimal Design of Construction //Middle European Scientific Bulletin. – 2021. – Т. 8.

38. Saidmamatov A. T. Theory of Optimal Design of Construction //Eurasian Journal of Engineering and Technology. – 2022. – Т. 11. – С. 43-48.

39. Саидмаматов А. Т. Решение задачи оптимизации параметров сейсмостойких железобетонных каркасных конструкций с оценкой влияния факторов пространственности, упругопластичности и нелинейности. – 1993.

40. Ходжиев Н. Р. Расчет зданий с элементами сейсмозащиты как нелинейных систем. – 1990.

41. Mardonov B., Latifovich A. H., Mirzoxid T. Experimental Studies of Buildings and Structures on Pile Foundations //Design Engineering. – 2021. – С. 9680-9685.

42. Alimov K., Buzrukov Z., Turgunpulatov M. Dynamic characteristics of pilot boards of structures //E3S Web of Conferences. – EDP Sciences, 2021. – Т. 264. – С. 02053.

43. Алимов Х. Л. Определения динамических характеристик свайных оснований сооружений. – 1991.

44. Sayfiddinov, S., Akhmadiyorov, U. S., & Akhmedov, P. S. (2020). OPTIMIZATION OF MODELING WHILE INCREASING ENERGY EFFICIENCY OF BUILDING STRUCTURES OF PUBLIC BUILDINGS. *Theoretical & Applied Science*, (6), 16-19.

45. Sayfiddinov, S., Akhmadiyorov, U. S., Razzokov, N. S. U., & Akhmedov, P. S. (2020). Ensuring Energy Efficiency Of Air Permeability Of Interfloor Ceilings In The Sections Of Nodal Connections. *The American Journal of Applied sciences*, *2*(12), 122-127.

46. Ahmedjon, T., & Pakhritdin, A. (2021). Stress-strain state of a dam-plate with variable stiffness, taking into account the viscoelastic properties of the material. *Asian Journal of Multidimensional Research (AJMR)*, *10*(3), 36-43.

47. Juraevich, R. S., Gofurjonovich, C. O., & Abdujabborovich, M. R. (2017). Stretching curved wooden frame-type elements "Sinch". *European science review*, (1-2), 223-225.

48. Kovtun I. Y., Maltseva A. Z. Improving the reliability of calculations of bases and soil massifs based on geotechnical control methods //Academicia: an international multidisciplinary research journal. – 2021. – Т. 11. – №. 1. – С. 1367-1375.

49. Ковтун И. Ю. Концептуальные предпосылки отчетного раскрытия информации о собственном капитале предприятия. – 2014.

50. Kovtun I. Y. Methods Without Formwork Molding of Reinforced Concrete Products //Eurasian Journal of Engineering and Technology. – 2022. – Т. 10. – С. 128-130.

51. Ковтун И. Ю., Мальцева А. З. КОНТРОЛИРУЕМЫЕ ПАРАМЕТРЫ И СРЕДСТВА ИЗМЕРЕНИЙ ПАРАМЕТРИЧЕСКИМ МЕТОДОМ ПРИ ГЕОТЕХНИЧЕСКОМ МОНИТОРИНГЕ ЗДАНИЙ И СООРУЖЕНИЙ. – 2021.

52. Рахимов А. М. и др. Ускорение твердения бетона при изготовлении сборных железобетонных изделий //Conferencea. – 2022. – С. 20-22.

53. Muminov K. K. et al. Physical Processes as a Result of Concrete Concrete in Dry-hot Climate Conditions //International Journal of Human Computing Studies. – Т. 3. – №. 2. – С. 1-6.